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(71)Applicant : FURUKAWA ELECTRIC CO
LTD:THE

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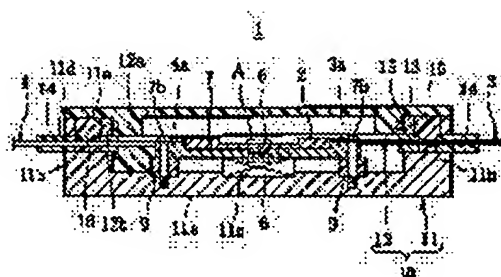
(72)Inventor : TORATANI TOMOAKI
SAITO TSUNEAKI

(54) OPTICAL WAVEGUIDE MODULE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a compact optical waveguide module allowed to be stably used over a long period even in an environment of high temperature and high humidity and to be easily assembled at the time of its manufacture by sealing the inside and outside of a package to prevent the generation of dew condensation on an optical waveguide component.

SOLUTION: In the optical waveguide module 1, at least a plane type optical waveguide component 2, a temperature sensor 5 for detecting the temperature of the component 2 and a temperature control element 6 for controlling the temperature of the component at a prescribed temperature are stored in a package 10 surrounding these parts. The inside and outside of the package 10 are airtightly sealed by sealing members 15, 16.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the optical waveguide module used for an optical transmission system, optical-information-processing equipment, etc.

[0002]

[Description of the Prior Art] Although the optical waveguide components of a flat-surface mold have the function to separate a signal spectrally with the wavelength of a lightwave signal, the spectral separation engine performance is influenced of temperature. For this reason, in order to keep temperature constant in the case of use, said optical waveguide component is contained in the package which has covering and the body with temperature control components, such as a Peltier device, and the modularization is carried out as an optical waveguide module. Here, temperature is usually controlled by said temperature control component before and after 45 degrees C from the engine performance of the adhesives which are using said optical waveguide component etc.

[0003] Therefore, in said optical waveguide module by which the modularization was carried out, if environmental temperature becomes an elevated temperature from 45 degrees C, said temperature control component will take heat from optical waveguide components, and will emit this heat to a package, for example. On the other hand, if environmental temperature becomes low temperature from 45 degrees C, said temperature control component will take heat from a package, and will give this heat to optical waveguide components.

[0004] For this reason, since a package needs to emit heat outside efficiently or needs to absorb it from the outside, it may attach the fin for the object for heat dissipation, or endoergic.

[0005]

[Problem(s) to be Solved by the Invention] By the way, as for said optical waveguide component, temperature is controlled by the temperature control component before and after 45 degrees C as mentioned above. For this reason, when the open air is heat and high humidity, said optical waveguide component is that the air which invaded in the package is cooled before and after 45 degrees C, dewes on optical waveguide and has a possibility of having a bad influence on temperature control or an optical property.

[0006] preventing that this invention was made in view of the above-mentioned point, and carries out the seal of the inside and outside of a package, and dew condensation generates it on optical waveguide components -- an elevated temperature -- even if it is a humid environment, it aims at offering the optical waveguide module in which the use continued and stabilized at the long period of time is possible. Furthermore, it is small also as said seal structure, and the assembly at the time of manufacture aims at offering an easy optical waveguide module.

[0007]

[Means for Solving the Problem] In order to attain the above-mentioned purpose in this invention, it is the optical waveguide module which contained the temperature control component which controls the temperature of said flat-surface mold optical waveguide component to predetermined temperature at

least at the temperature sensor list which detects the temperature of flat-surface mold optical waveguide components and these flat-surface mold optical waveguide components in the package which surrounds these, and inside and outside considered said package as the configuration in which the seal is airtightly carried out by the seal member.

[0008]

[Embodiment of the Invention] Hereafter, the 1st operation gestalt concerning the optical waveguide module of this invention is explained to a detail based on drawing 1 thru/or drawing 5. As the optical waveguide module 1 is shown in drawing 1 and drawing 2, the flat-surface mold optical waveguide components (only henceforth "optical waveguide components") 2, the temperature sensor 5, and the temperature control component 6 are contained in the package 10 at least.

[0009] The optical waveguide components 2 are array optical waveguide components (AWG) of the flat-surface mold with which the waveguide of a request pattern was formed on the substrate, and as shown in drawing 2, they are being fixed on the soak plate 7. As for the optical waveguide components 2, optical connectors 3a and 4a are connected to both sides, respectively. Optical connectors 3a and 4a are attached in the edge of two or more incidence fibers 3 and the outgoing radiation fiber 4, respectively.

[0010] A temperature sensor 5 is the thermistor which detects the temperature of the optical waveguide components 2, and as shown in drawing 3, positioning arrangement is carried out with the pressure plate 8 at receipt slot 7a formed in the top face of the soak plate 7. A temperature sensor 5 transmits a temperature signal to an external control unit (not shown) by two electric-wires 5a. Here, the soak plate 7 holds the temperature of the optical waveguide components 2 to homogeneity, and the copper plate which performed nickel plating is used. The soak plate 7 is attached in the metal base 11 by setscrew 7b through the spacer 9 arranged between the metal bases 11 mentioned later, as shown in drawing 2.

[0011] Positioning arrangement is carried out at crevice 11c formed in the center of abbreviation of the metal base 11 mentioned later, and the temperature control component 6 is held between the soak plate 7 and the metal base 11 mentioned later, as a Peltier device is used and it is shown in drawing 2. As the temperature control component 6 is shown in drawing 1, an actuation current is supplied from two electric-wires 6a which has extended out of a package 10.

[0012] A package 10 has the metal base 11 and covering 12, and drawing 1 shows the condition of having removed covering 12. The metal base 11 is fabricated from the material excellent in thermal conductivity, such as copper or aluminum, and functions as a heat sink. As the metal base 11 is shown in drawing 2, peripheral wall 11b is formed in the perimeter of base 11a, and crevice 11c which positions the temperature control component 6 is prepared in the center of abbreviation. As for the metal base 11, 11d of wearing holes is formed in three places of peripheral wall 11b, and Shilu 11e which is open for free passage from the top face of peripheral wall 11b to 11d of wearing holes is prepared.

[0013] Here, 11d of two wearing holes with which 11d of three wearing holes was formed in peripheral wall 11b located in longitudinal direction both sides is equipped with rubber boots 13 and 14 from inside and outside, respectively. Rubber boots 13 and 14 are fabricated by tubed from elastic bodies, such as isobutylene isoprene rubber, and they are protected from bending so that two or more incidence fibers 3 and outgoing radiation fibers 4 which extend from a package 10 may not be disconnected. On the other hand, 11d of one wearing hole which remains is used for making two electric-wires of temperature sensor 5 5a, and two electric-wires 6a of the temperature control component 6 extend out of a package 10.

[0014] Covering 12 is the cover plate which consists of synthetic resin, such as a glass epoxy resin, and fitting wall 12a by which fitting is carried out inside peripheral wall 11b is formed in the inferior surface of tongue. Seal-groove 12b is formed in a periphery, and, as for fitting wall 12a, O ring 15 is arranged at seal-groove 12b. Covering 12 carries out fitting of the fitting wall 12a inside peripheral wall 11b, and is put on a protective case 12.

[0015] The optical waveguide module 1 is constituted as mentioned above, and attaches in the metal base 11 the soak plate 7 which fixed the optical waveguide components 2 by setscrew 7b through a spacer 9. It lets rubber boots 13 and 14 pass for two or more incidence fibers 3 and outgoing radiation

fibers 4, and it lets 11d of wearing holes pass, and two electric wires 5a and 6c are made to extend out of a package 10 with this, respectively. After an appropriate time, impregnation solidification of the sealing compounds, such as 2 liquid hybrid model conversion acrylate system resin, is carried out, it considers as the seal member 16, covering 12 is put on the metal base 11, and it is assembled by 11d of three wearing holes at the optical waveguide module 1.

[0016] Therefore, as for the optical waveguide module 1, the seal of the inside and outside of a package 10 is airtightly carried out by O ring 15 and the seal member 16. for this reason, the thing for which air invades in a package 10 and dew condensation generates the optical waveguide module 1 on the optical waveguide components 2 -- there is nothing -- an elevated temperature -- even if it is a humid environment, the use by which continued at the long period of time and temperature control and an optical property were stabilized is possible. And since the optical waveguide module 1 is the structure which carries out the seal of the inside and outside of a package 10 airtightly by O ring 15 and the seal member 16, it is small and the assembly at the time of manufacture is easy for it.

[0017] Next, the 2nd operation gestalt concerning the optical waveguide module of this invention is explained to a detail based on drawing 4 and drawing 5. As the optical waveguide module 20 is shown in drawing 4 and drawing 5, the optical waveguide components 21, the temperature sensor 25, and the temperature control component 26 are contained in the package 30 at least.

[0018] The optical waveguide components 21 are array optical waveguide components (AWG) of the flat-surface mold with which the waveguide of a request pattern was formed on the substrate, and as shown in drawing 5, they are being fixed on the soak plate 27. As for the optical waveguide components 21, optical connectors 22a and 23a are connected to both sides, respectively. Optical connectors 22a and 23a are attached in the end of two or more incidence fibers 22 and the outgoing radiation fiber 23, respectively. As for two or more incidence fibers 22 and outgoing radiation fibers 23, optical connectors 22b and 23b are attached in the other end.

[0019] A temperature sensor 25 is the thermistor which detects the temperature of the optical waveguide components 21, and positioning arrangement is carried out with the pressure plate like the temperature sensor 5 of the optical module 1 in the receipt slot formed in the top face of the soak plate 27. A temperature sensor 25 transmits a temperature signal to an external control unit (not shown) by two electric-wires 25a. Here, the soak plate 27 holds the temperature of the optical waveguide components 21 to homogeneity, and the copper plate which performed nickel plating is used. The soak plate 27 is attached in the metal base 31 by setscrew 27a through the spacer 29 arranged between the metal bases 31 mentioned later, as shown in drawing 5.

[0020] Positioning arrangement is carried out at crevice 31c formed in the center of abbreviation of the metal base 31 mentioned later, and the temperature control component 26 is held between the soak plate 27 and the metal base 31 mentioned later, as a Peltier device is used and it is shown in drawing 5. As the temperature control component 26 is shown in drawing 4, an actuation current is supplied from two electric-wires 26a. A package 30 has the metal base 31, the inside case 32, the outside case 33, and covering 34, and drawing 4 shows the condition of having removed covering 34.

[0021] The metal base 31 is fabricated from the material excellent in thermal conductivity, such as copper or aluminum, and functions as a heat sink. Step 31a to which the metal base 31 arranges the inside case 32 and the outside case 33 as shown in drawing 5 is formed in a periphery, and crevice 31b which positions the temperature control component 26 is prepared in the center of abbreviation.

[0022] The inside case 32 is the tubed member fixed to the metal base 31 so that the inner circumference side of step 31a may be surrounded, and as shown in drawing 4, fiber slot 32a which arranges two or more incidence fibers 22 and outgoing radiation fibers 23 is formed. Moreover, the extension hole (not shown) which makes two electric-wires of temperature sensor 25 25a and two electric-wires 26a of the temperature control component 26 extend to the exterior is prepared in the inside case 32.

[0023] The outside case 33 is arranged at the periphery side of step 31a so that seal-groove T (refer to drawing 4) may be formed between the inside cases 32, is the tubed member which surrounds the inside case 32, and is fixed to the metal base 31 by setscrew 33a. The outside case 33 is formed in the location where two wearing hole 33b equipped with the optical connectors 22b and 23b attached in the other end

of two or more incidence fibers 22 and the outgoing radiation fiber 23 opposes fiber slot 32a as shown in drawing 5 . Moreover, as shown in the outside case 33 at drawing 4 , connector hole 33c which attaches an electrical connector 35 is formed.

[0024] Other electrical connectors which two electric-wires of temperature sensor 25 25a and two electric-wires 26a of the temperature control component 26 which extended from the extension hole with which the inside case 32 does not illustrate an electrical connector 35 connect with the power source which supplies an actuation current to the control unit which connects and the exterior does not illustrate, or the temperature control component 26 are connected. Covering 34 is the cover plate which consists of synthetic resin, such as a glass epoxy resin, and is fixed to the metal base 31 by setscrew 34a through the inside case 32.

[0025] The optical waveguide module 20 is constituted as mentioned above, and attaches in the metal base 31 the soak plate 27 which fixed the optical waveguide components 21 by setscrew 27a through a spacer 29. With this, the inside case 32 is arranged to the step 31a inner circumference side of the metal base 31, and two or more incidence fibers 22 and outgoing radiation fibers 23 are arranged to fiber slot 32a of the inside case 32.

[0026] And while equipping wearing hole 33b with the optical connectors 22b and 23b of the incidence fiber 22 and the outgoing radiation fiber 23, the outside case 33 is fixed to the metal base 31 by setscrew 33a. At this time, two electric-wires of temperature sensor 25 25a and two electric-wires 26a of the temperature control component 26 are made to extend from the extension hole which the inside case 32 does not illustrate, and connect with the electrical connector 35.

[0027] Moreover, covering 34 is put on the inside case 32, and is fixed to the metal base 31 by setscrew 34a with the inside case 32. After an appropriate time, impregnation solidification of the sealing compounds, such as 2 liquid hybrid model conversion acrylate system resin, is carried out, and it considers as the seal member 36, and is assembled by the optical waveguide module 20 at seal-groove T formed between the inside case 32 and the outside case 33.

[0028] Therefore, as for the optical waveguide module 20, the seal of the inside and outside of a package 30 is airtightly carried out by the seal member 36. for this reason, the thing for which air invades in a package 30 and dew condensation generates the optical waveguide module 20 on the optical waveguide components 21 -- there is nothing -- an elevated temperature -- even if it is a humid environment, the use by which continued at the long period of time and temperature control and an optical property were stabilized is possible. And since the optical waveguide module 20 is the structure which carries out the seal of the inside and outside of a package 30 airtightly by the seal member 36, it is small and the assembly at the time of manufacture is easy for it.

[0029]

[Effect of the Invention] preventing that according to invention of claim 1 carry out the seal of the inside and outside of a package, and dew condensation occurs on optical waveguide components -- an elevated temperature -- even if it is a humid environment, an optical waveguide module with the assembly it is small and easy the top in which the use continued and stabilized at the long period of time is possible, at the time of manufacture can be offered.

[Translation done.]

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CLAIMS

[Claim(s)]

[Claim 1] Said package is an optical waveguide module with which it is characterized by being the optical waveguide module which contained the temperature control component which controls the temperature of said flat-surface mold optical waveguide component to predetermined temperature at least at the temperature sensor list which detects the temperature of flat-surface mold optical waveguide components and these flat-surface mold optical waveguide components in the package which surrounds these, and the seal of the inside and outside being airtightly carried out by the seal member.

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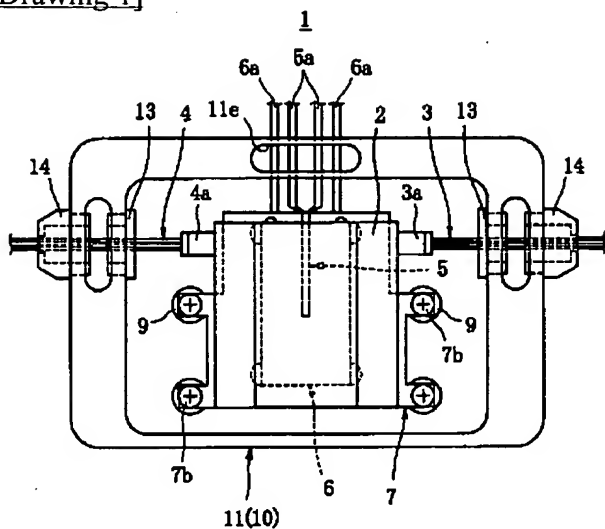
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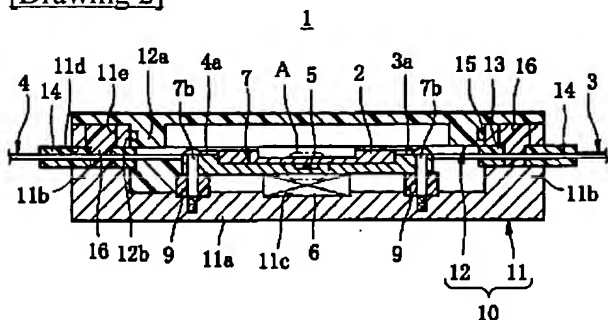
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DRAWINGS

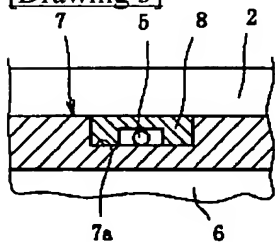
[Drawing 1]



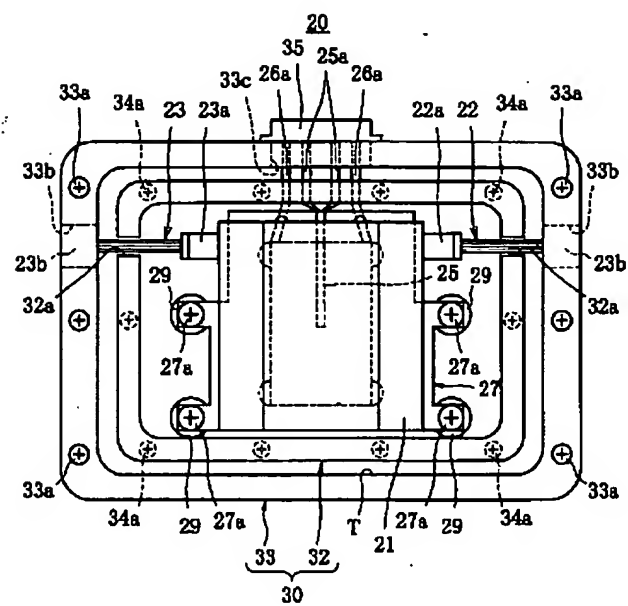
[Drawing 2]



[Drawing 3]

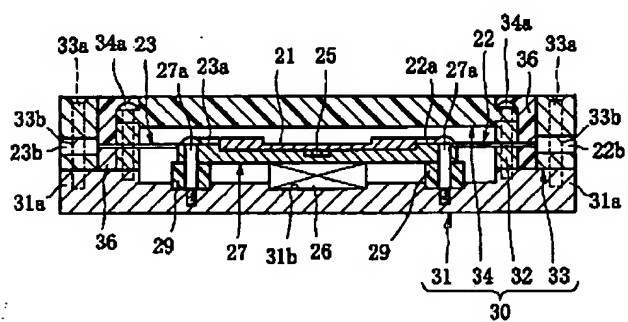


[Drawing 4]



[Drawing 5]

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